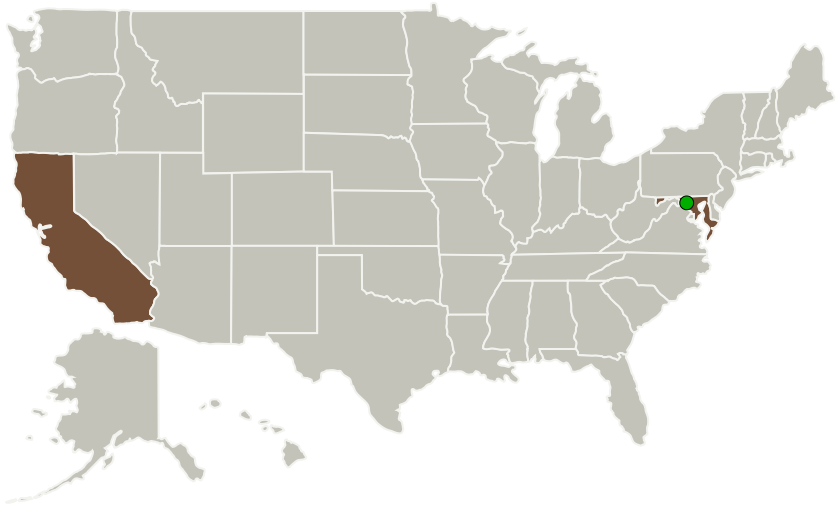
A Novel Approach to Improving the Radiation Hardness of SiC Power Devices, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

Silicon Carbide Technology for power semiconductors offers a significant improvement in capability that will allow systems to operate at higher voltages and temperature and offer greater efficiency. However, the current state of the art for this technology proves to have significant issues that prevent its use in the space environment. Specifically the susceptibility to heavy ion damage that requires significant derating of the devices to a point that makes their use not practical. The problem for SiC MOSFET?s appears to make these devices unusable in space system due to the extremely low operating voltage where damage occurs within the device. This proposal will focus on SiC MOSFET and propose a novel approach to significantly improve the heavy ion performance to a level where the use of SiC MOSFET?s constructed using this approach would be feasible in most space applications. Semicoa is teamed with General Electric Global Research Center (GEGR) to solve this issue and provide a pathway to bring these devices to the space market fully qualified to military specifications. The focus of this effort will be to further optimize the hardening techniques being investigated by GEGR and develop a novel approach to depositing the gate oxide with Atomic Layer Deposition (ALD) techniques. This approach will allow the use of a much thicker gate oxide, while maintaining the total dose hardness characteristics, and provide significant improvement to the heavy ion performance. The challenge will be addressing the interface between the dielectric and the semiconductor. It is believed that the ALD process using a High-K dielectric material will lower the interface state density to achieve the total dose hardness while at the same time provide for a significant improvement in the heavy ion performance.

Primary U.S. Work Locations and Key Partners



A novel approach to improving the radiation hardness of SiC Power Devices, Phase I

Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

A Novel Approach to Improving the Radiation Hardness of SiC Power Devices, Phase I

Completed Technology Project (2016 - 2016)

Organizations Performing Work	Role	Type	Location
Falkor Partners, LLC dba: Semicoa	Lead Organization	Industry	Costa Mesa, California
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Transitions

June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139868)*

Images

Briefing Chart Image
A novel approach to improving the radiation hardness of SiC Power Devices, Phase I
(https://techport.nasa.gov/image/130870)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Falkor Partners, LLC dba: Semicoa

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

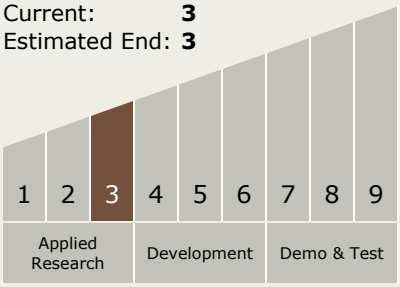
Carlos Torrez

Principal Investigator:

Brian P Triggs

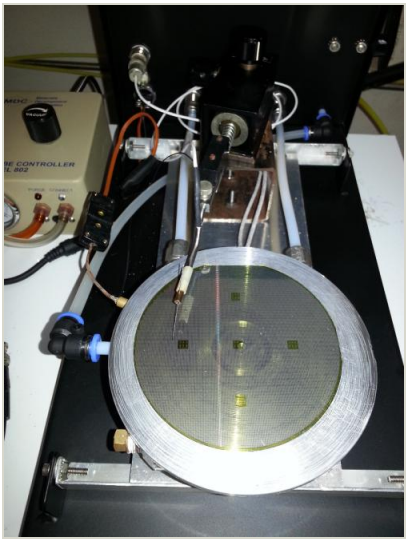
Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**



A Novel Approach to Improving the Radiation Hardness of SiC Power Devices, Phase I

Completed Technology Project (2016 - 2016)



Final Summary Chart Image
A novel approach to improving the radiation hardness of SiC Power Devices, Phase I Project Image *(https://techport.nasa.gov/image/125763)*

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.3 Power Management and Distribution
    - TX03.3.4 Advanced Electronic Parts

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System